

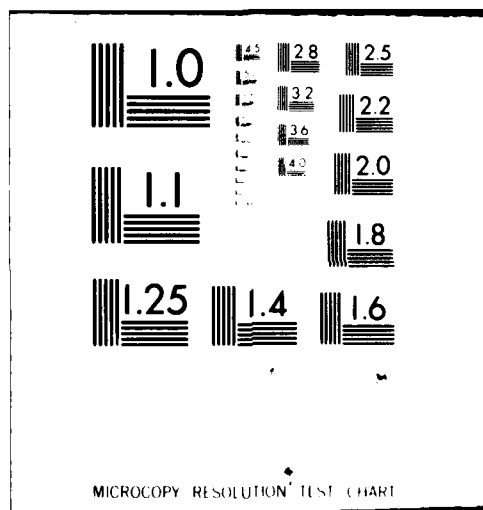
NATIONAL AVIATION FACILITIES EXPERIMENTAL CENTER ATL--ETC F/G 1/2
LOS ANGELES INTERNATIONAL AIRPORT DATA PACKAGE NUMBER 9, AIRPOR--ETC(U)
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6 **LOS ANGELES
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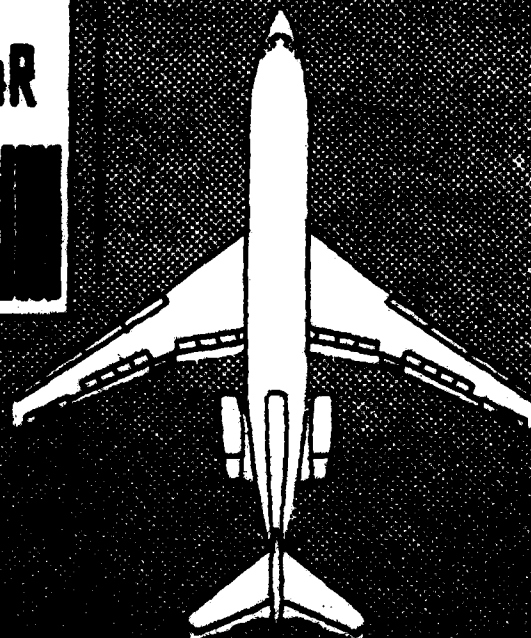
DATA PACKAGE ^{Number} **NO. 9**
**AIRPORT IMPROVEMENT
TASK FORCE DELAY STUDIES.**

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**DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION**

DATE: April 29, 1980

**IN REPLY
REFER TO:**

**NATIONAL AVIATION FACILITIES
EXPERIMENTAL CENTER
ATLANTIC CITY, NEW JERSEY 08405**



SUBJECT: Los Angeles Simulation Model Results

FROM: Program Manager, ANA-220

TO: Frank Jones, AWE-530

Enclosed is data package No. 9 for review by the Task Force members. Data package No. 8 was presented at the last meeting of the Task Force on January 30, 1980.

Attachment A is a list of the Stage 1 and Stage 2 experiments. Link node diagrams for the airport are included showing the present and near term improvements.

Attachment B shows the distribution of heavy aircraft departures for the 1978 demand. This information was requested by the task force since the last meeting, and reflects the fact that there is a higher number of heavy aircraft departures in the morning hours as compared to the early afternoon.

Attachment C contains the results of the Stage 2 experiments. The results of the experiments are presented in two sets (sets 6 and 7 representing a continuation of the results presented in data package No. 7).

Set 6 - Experiments 18, 18A, 19A, 20, 21, 22, 22A, 25, and 25A.

Set 7 - Experiments 23, 24, and 26.

Set 6 of the Stage 2 experiments deals with the VFR-1 weather conditions during westerly flow of traffic. The demand for each experiment (aircraft schedule) is shown in Table 3. One experiment (18A) has been added to the Stage 2 to permit the comparison of the dual taxiway improvement before and after tunnel construction. Experiment 18 was exercised (without tunnel improvements) in two cases. One with the same demand as experiment 7 (1982 demand) and then repeated with the departures rerouted to runway 24R when a queue of 4 built-up on runway 25R. Experiment 18A was performed using the same demand as experiment 11 (1982 demand) with departures rerouted to runway 24R when a queue of 4 built-up on runway 25R.

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Set 7 of the Stage 2 experiments deals with the IFR weather conditions during westerly flow of traffic. The demand is shown in Table 16 for the experiments.

Attachment D is a summary of experiment results for total delays and travel time accumulated during the time frame the experiments were simulated (0700 to 1500). (The computer output generated data for the last hour (1500 to 1600) as a clean-up time for the simulation which had no demand for that hour).

Attachment E lists a number of initial comparisons of experiment which isolate particular improvement with their effect on either the delays or travel times.

Attachment F includes the summary of annual delays calculated in a manner similar to the yearly aircraft operations shown in Table 8 of data package No. 5.


JOHN R. VANDERVEER

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ATTACHMENT A

LOS ANGELES DELAY EXPERIMENTS

LOS ANGELES INTERNATIONAL AIRPORT

AIRPORT IMPROVEMENT TASK FORCE DELAY STUDIES

TABLE 1
LOS ANGELES DELAY EXPERIMENTS

Experiment number	Model	Study case ^a	Arrival runways	Departure runways	Weather	Demand	ATC System ^b scanario	Near Term improvements
Stage 1 Experiments								
1	ASM	d	24L, 24R, 25L, 25R	24L, 24R, 25L, 25R	VFR1	1978	1978	None
2	ASM	2	24L, 24R, 25L, 25R	24L, 25R	IFR1	1978	1978	None
3	ASM	3	24R, 25L	24L, 25R	IFR2	1978	1978	None
4	ASM	5	6R, 7L	24L, 25R	VFR1	1978	1978	None
5	ASM	6	6R, 7L	24L, 25R	IFR1	1978	1978	None
6	ASM	4	6L, 6R, 7L, 7R	6L, 6R, 7L, 7R	VFR1	1978	1978	None
7 (7A) (7B)	ASM	1	24L, 24R, 25L, 25R	24L, 24R, 25L, 25R	VFR1	1982 (+5%) (+15%) 1978	1978	None
8 (8A) (8B)	ASM	2	24L, 24R, 25L, 25R	24L, 25R	IFR1	1982 (+5%) (+15%) 1978	1978	None
9	ASM	4	6L, 6R, 7L, 7R	6L, 6R, 7L, 7R	VFR1	1982	1978	None
10	ASM	5	6R, 7L	24L, 25R	VFR1	1982	1978	None
10A	ASM	6	6R, 7L	24L, 25R	IFR1	1982	1978	None
11	ASM	1	24L, 24R, 25L, 25R	24L, 24R, 25L, 25R	VFR1	1982	1982	1982 ^e
12	ASM	2	24L, 24R, 25L, 25R	24L, 25R	IFR1	1982	1982	1982
13	ASM	1	24L, 24R, 25L, 25R	24L, 24R, 25L, 25R	VFR1	1982	1982	2, 3 ^f
15	ASM	5	6R, 7L	24L, 25R	VFR1	1982	1982	5, 7 ^g
16	ASM ^h	4	6L, 6R, 7L, 7R	6L, 6R, 7L, 7R	VFR1	1982	1982	5, 7, 8 ^g
17	ADM ^h	n.a.	n.a.	n.a.	n.a.	1978	1978	None
17A	RCM ⁱ	7	24L, 24R, 25L	24L, 24R, 25L	VFR1	1982	1982	Tunnel Construction ^j
17B	RCM	7	24L, 24R, 25L, 25x ^k	24L, 24R, 25L, 25X	VFR1	1982	1982	Tunnel Construction
17C	RCM	7	24L, 24R, 25L, 26	24L, 24R, 25L, 26	VFR1	1982	1982	Comments-Usage for Light

n.a. = not applicable.

a. Study cases (combinations of runway use and weather conditions) are defined in Figure III-1.

b. FAA will describe impact of 1982 and post-1987 ATC systems on model inputs.

c. Potential near-term improvements are identified in the Los Angeles International Airport Improvement Task Force Interim Report, and in Appendix B.

d. Airfield Simulation Model.

e. Task Force establishes packages of near-term improvements most likely to be implemented in 1982 and 1987 time frames. The 1982 package includes improvement # 2 (high-speed taxiway off Runway 25L to the south), improvement # 3 (strengthening of the Sepulveda Tunnel), (cont.)

TABLE 1 (CONTINUED)

- e. (cont.) new taxiway access to threshold of Runway 24R, and temporary holding areas on future Taxiway 75. The 1987 package includes all 1982 improvements plus Satellite 1, International Terminal, and/or remote parking for 20 aircraft at west end of airport. These packages of improvements are subject to Task Force review and revision.
- f. Impact of absence of Improvements # 2 and #3 (high-speed taxiway of Runway 25L and strengthening of the Sepulveda Tunnel).
- g. Improvement # 5 is a high-speed taxi exit off Runway 7. Improvement # 7 is a high-speed taxi exit to Taxiway 47 from Runway 6R. Improvement #8 is a bypass area on the north side of Runway 7L.
- h. Annual Delay Model.
- i. Runway Capacity Model.
- j. Runway 25R closed for tunnel construction.
- k. During closure of 25R for tunnel construction, parts of Runway 25 are open for small aircraft arrivals and departures.

TABLE 1
LOS ANGELES DELAY EXPERIMENTS

Experiment number	Model	Study case ^a	Arrival Runways	Departure Runways	Weather	Demand	ATC System scenario ^b	Near-term improvements ^c
Stage 2 Experiments								
18	ASM	1	24L, 24R, 25L, 25R	24L, 24R, 25L, 25R	VFR1	1982	1982	10 ¹
19 A	ASM	1	24L, 24R, 25L, 25R	24L, 24R, 25L, 25R	VFR1	1982	1978	Terminal Expansion ⁿ
20	ASM	1	24L, 24R, 25L, 25R	24L, 24R, 25L, 25R	VFR1	1982	1982	Terminal Expansion ⁿ
21	ASM	1	24L, 24R, 25L, 25R	24L, 24R, 25L, 25R	VFR1	1982	1982	Remote Terminal ^o
22	ASM	7	24L, 24R, 25L	24L, 24R, 25L	VFR1	1982	1978	Tunnel Construction
22A	ASM	8	24L, 24R, 25L	24L, 24R, 25L	VFR1	1982	1978	Dual Taxiway ^p
23	ASM	8	24R, 25L	24L, 25L	IFR1	1982	1978	Tunnel Construction 25R
24	ASM	9	24R, 25R	24L, 25R	IFR1	1982	1978	Tunnel Construction 25L
25	ASM	1	24L, 24R, 25L, 25R	24L, 24R, 25L, 25R	VFR1	1987	1987	1987 ^e
25A	ASM	1	24L, 24R, 25L, 25R	24L, 24R, 25L, 25R	VFR1	1987	1987	1987
26	ADM	2	24L, 24R, 25L, 25R	24L, 24R	IFR1	1982	1982	1982
27	ADM	n.a.	n.a.	n.a.	n.a.	1982	1982	1982
28	ADM	n.a.	n.a.	n.a.	n.a.	1982	1982	1982
29	ADM	n.a.	n.a.	n.a.	n.a.	1982	1982	1982
30	ADM	n.a.	n.a.	n.a.	n.a.	1982	1982	1982
31	ADM	n.a.	n.a.	n.a.	n.a.	1987	1987	1987
32	ADM	n.a.	n.a.	n.a.	n.a.	1987	1987	1987
33	ADM	n.a.	n.a.	n.a.	n.a.	1987	1987	1987
34	ADM	n.a.	n.a.	n.a.	n.a.	1987	1987	1987

1. Improvement #10 consists of a series of taxiway improvements identified in Appendix B.

n. Construction of Satellite 1 and International Terminal. The need for this experiment will be reviewed by the Task Force after consideration of future airline terminal locations.

o. Remote parking for 20 aircraft at west end of Airport.

p. Additional experiment may be needed to test value of dual taxiway system around Satellite 4 during tunnel constructionl

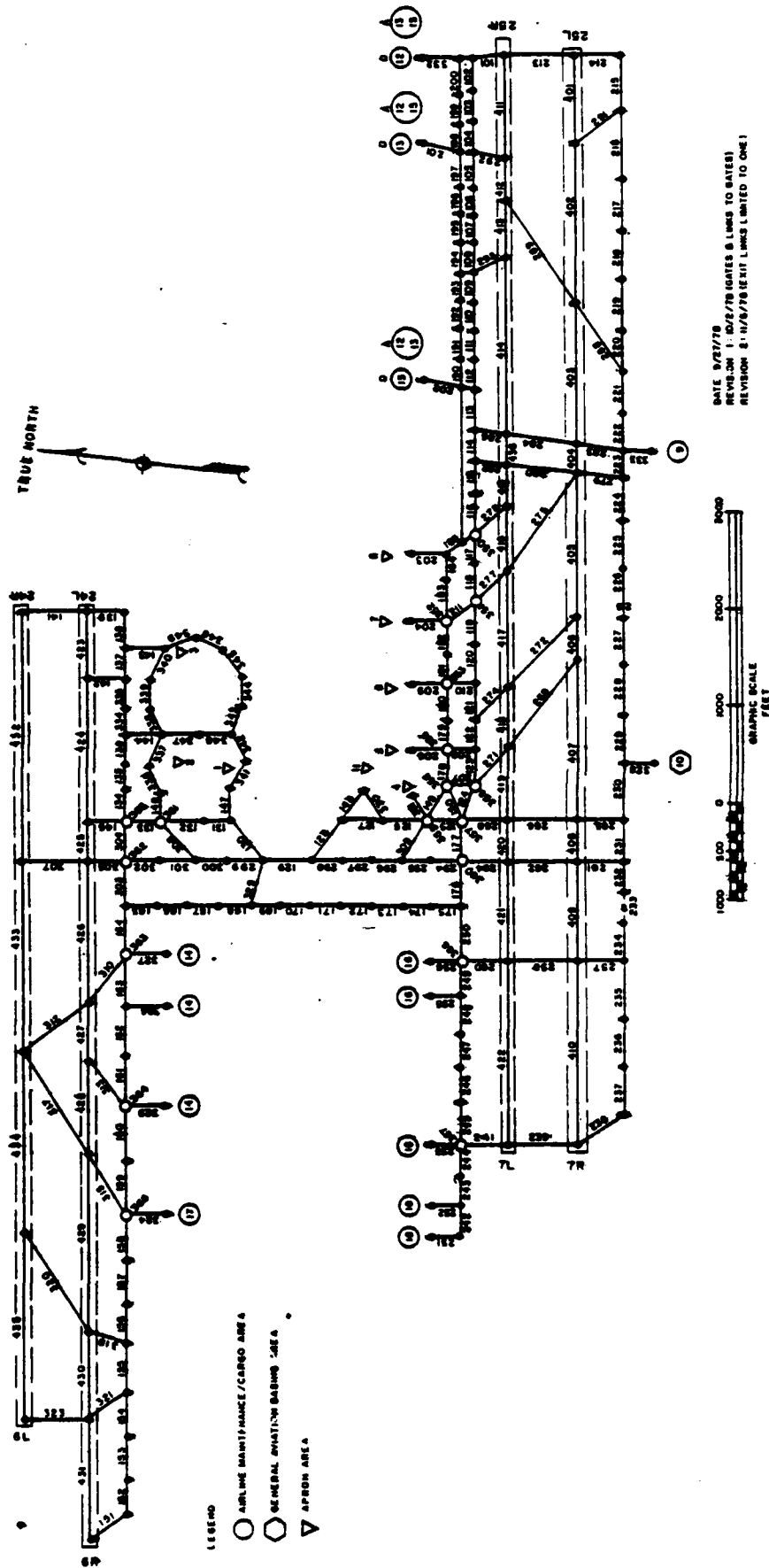
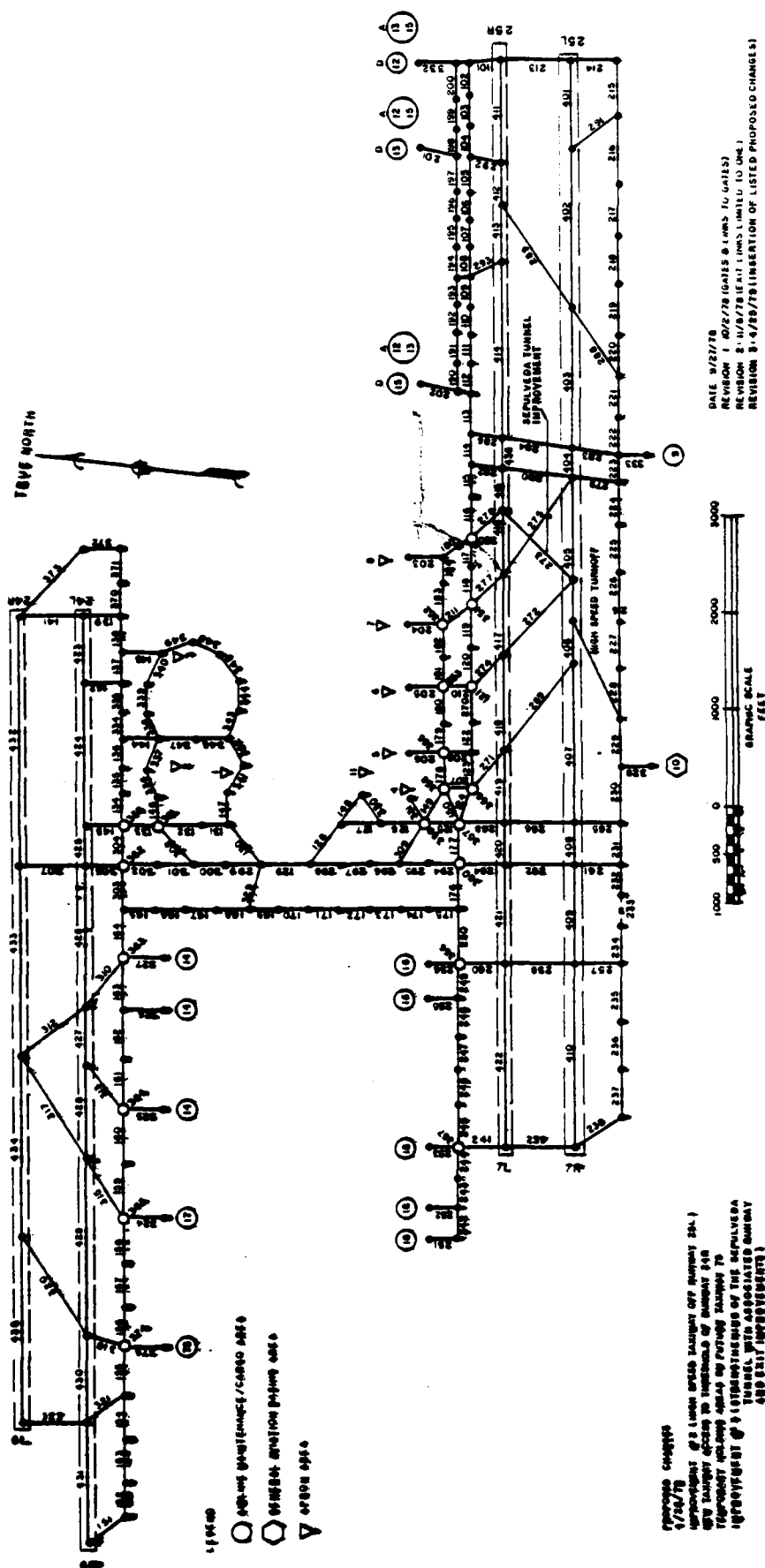


Figure 1 LAX LINK NODE DIAGRAM (PRESENT)



**Figure 2 LAX LINK NODE DIAGRAM
(NEAR TERM IMPROVEMENTS)**

ATTACHMENT B

DISTRIBUTION OF HEAVY DEPARTURES
1978 DEMAND

TABLE 2

TIME	TOTAL DEPARTURES (HEAVY)	TOTAL NORTH SIDE DEPARTURES (HEAVY)	TOTAL CROSS-OVERS TO SOUTH SIDE DEPARTURE FIX
0700	12	10	6
0800	16	15	11
0900	17	17	14
1000	7	7	4
1100	5	5	5
1200	17	16	11
1300	13	13	8
1400	3	3	3
TOTAL	90	86	62 (72.1%)
0700 TO 1100	52	49	35 (71%)
1100 TO 1500	38	37	27 (73%)

ATTACHMENT C

LOS ANGELES STAGE 2 DELAY EXPERIMENTS

LOS ANGELES INTERNATIONAL AIRPORT

AIRPORT IMPROVEMENT TASK FORCE DELAY STUDIES

TABLE 3

9

SET 6 DEMAND

EXPERI- MENT		RWY 24R	RWY 24L	RWY 25R	RWY 25L	TOTAL
18 (7 AND 13)	A	71	17	105	170	363
	D	42	171	135	78	426
	TOTAL	113	188	240	248	789
18A (11)	A	71	17	105	170	363
	D	25	117	193	91	426
	TOTAL	96	134	298	261	789
19A AND 20	A	72	14	93	184	363
	D	52	172	130	72	426
	TOTAL	124	186	223	256	789
21	A	70	18	105	170	363
	D	42	171	135	78	426
	TOTAL	112	189	240	248	789
22 AND 22A	A	95	72	0	196	363
	D	29	162	0	235	426
	TOTAL	124	234	0	431	789
25	A	96	66	84	123	369
	D	37	124	164	107	432
	TOTAL	133	190	248	230	801
25A	A	98	68	89	125	380
	D	38	129	168	109	444
	TOTAL	136	197	257	234	820

LAX - STAGE 2EXPERIMENT NO. 18 (18A)Objective:

To assess delays to aircraft in 1982 for the following runway configuration in VFR I with an improved ATC system scenario (1982) and improvement #10 (taxiways). Experiment 18A includes the near term improvements.

ARRIVAL RUNWAYS

24R, 24L, 25R, 25L

DEPARTURE RUNWAYS

24R, 24L, 25R, 25L

Related Comparison Experiments:

Prior Experiment #11 is identical except for improvement #10 (taxiway improvements).

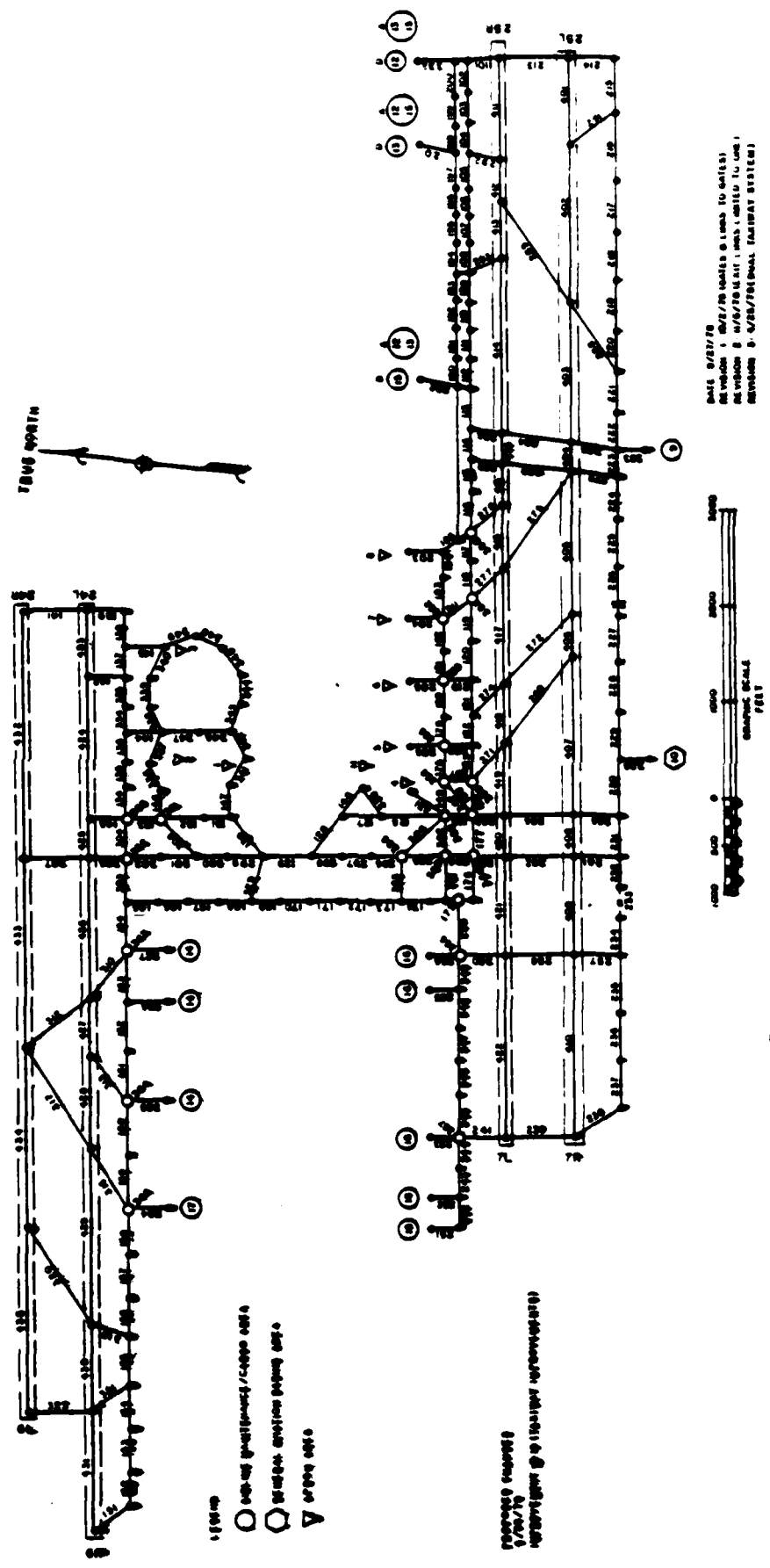


Figure 3 LAX LINK NODE DIAGRAM (DUAL TAXIWAY)

LAX - STAGE 2EXPERIMENT NO. 19AObjective:

To assess delays to aircraft in 1982 for the following runway configuration in VFR 1 with terminal expansion.

ARRIVAL RUNWAYS

24R, 24L, 25R, 25L

DEPARTURE RUNWAYS

24R, 24L, 25R, 25L

Related Comparison Experiments:

Experiment #20 is identical except for an improved ATC system scenario.

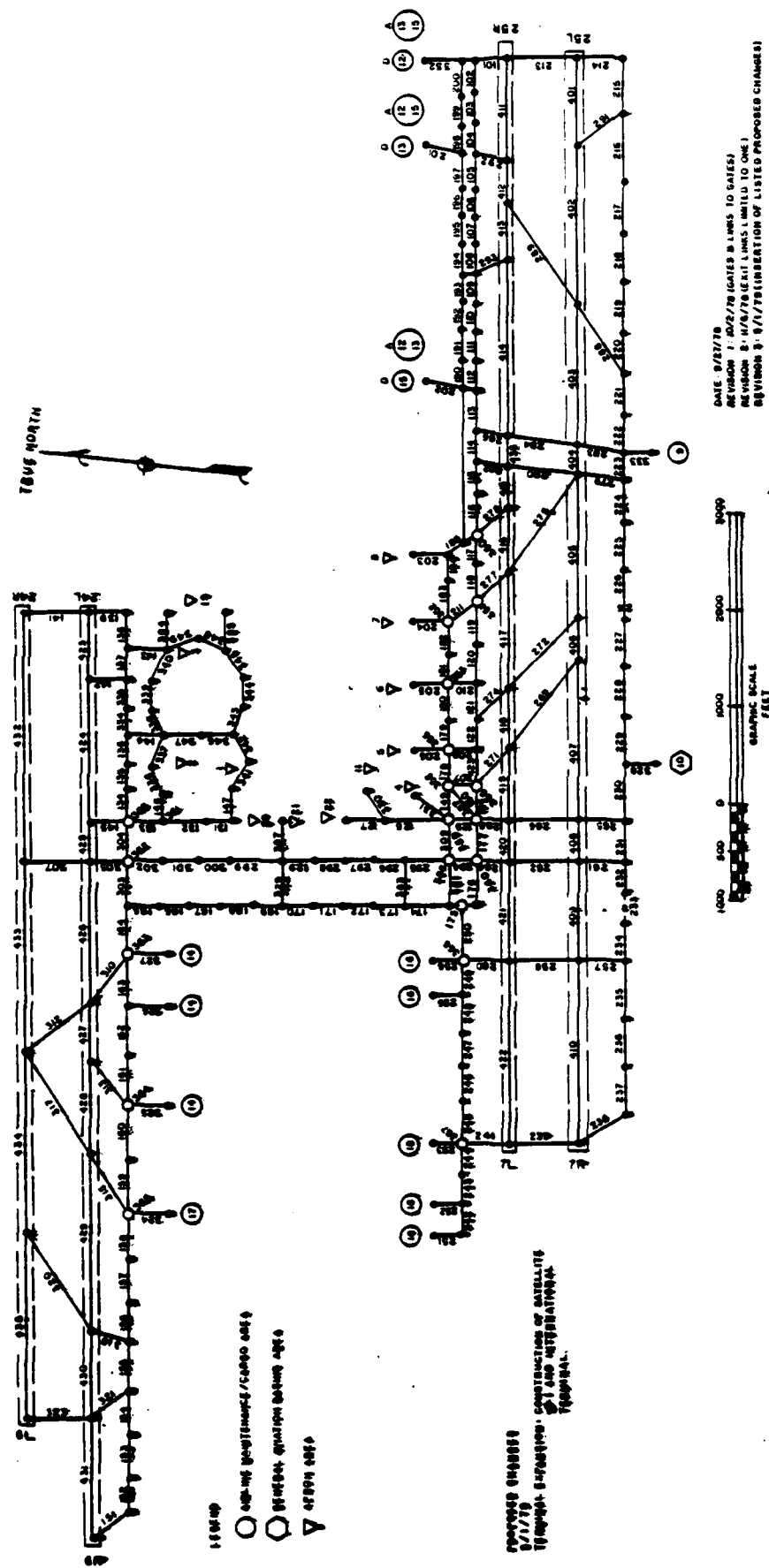


Figure 4 LAX LINK NODE DIAGRAM (TERMINAL EXPANSION)

LAX - STAGE 2EXPERIMENT NO. 20Objective:

To assess delays to aircraft in 1982 for the following runway configuration in VFR I with an improved ATC system scenario and terminal expansion.

ARRIVAL RUNWAYS

24R, 24L, 25R, 25L

DEPARTURE RUNWAYS

24R, 24L, 25R, 25L

Related Comparison Experiments:

Experiment #21 is identical except for remote parking for 20 aircraft at west end of airport in place of terminal expansion.

Prior Experiment #19A is identical except for a 1978 ATC system scenario.

TABLE 8

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LAX - STAGE 2EXPERIMENT NO. 21Objective:

To assess delays to aircraft in 1982 for the following runway configuration in VFR 1 with an improved ATC system scenario and remote parking for 20 aircraft.

ARRIVAL RUNWAYS

24R, 24L, 25R, 25L

DEPARTURE RUNWAYS

24R, 24L, 25R, 25L

Related Comparison Experiments:

Prior Experiment #20 is identical except for remote parking for 20 aircraft at west end of airport in place of terminal expansion.

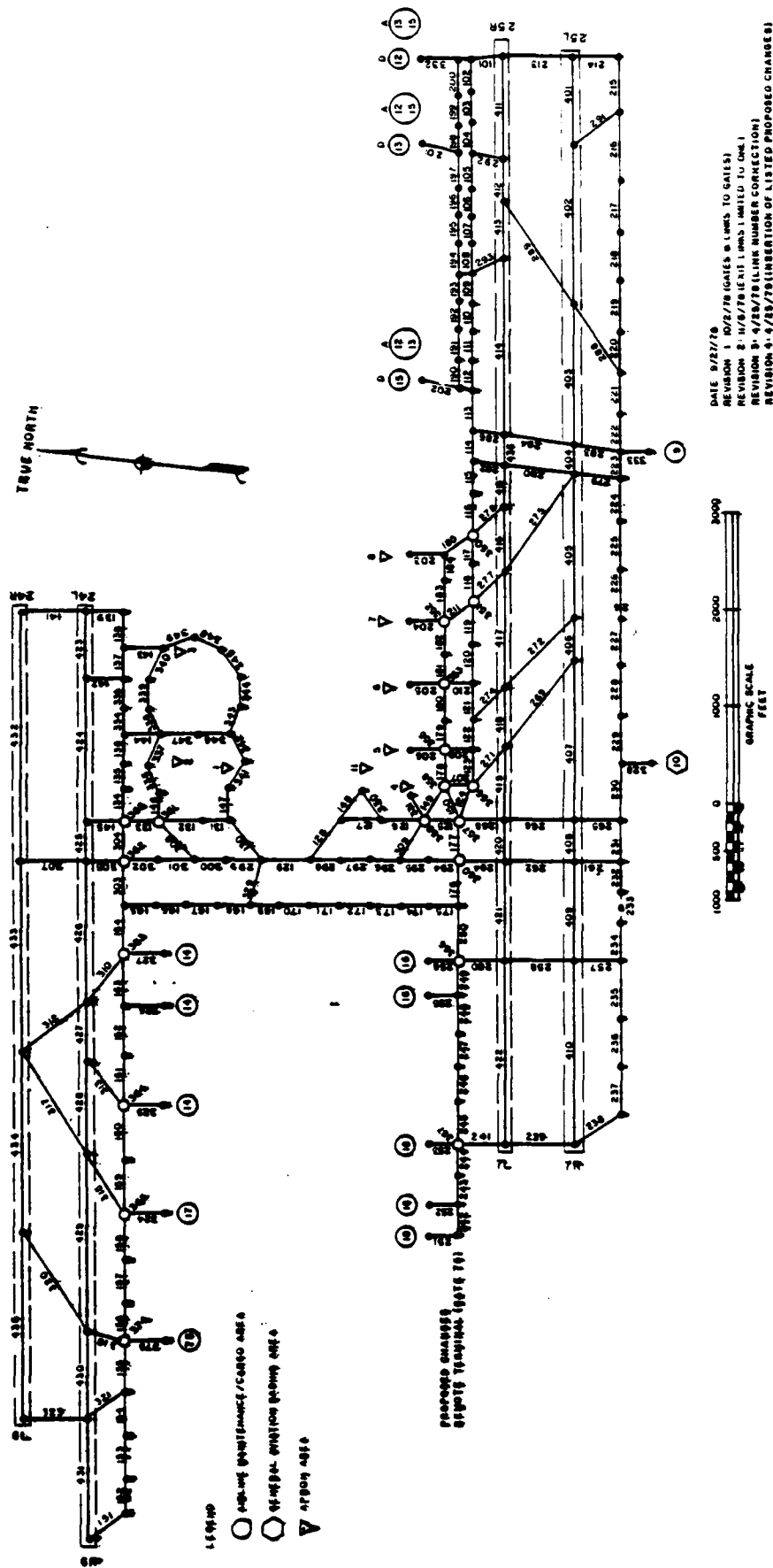


Figure 5 LAX LINK NODE DIAGRAM
(REMOTE TERMINAL)

TABLE 9

TIME	LAX EXP 21										DEMAND=82 SEP=82VFR1 CONFIG=A SCHED=X21 RTE=X1 NORMAL										AVERAGE TRAVEL TIMES			
	ARRIVALS										DEPARTURES										FIX TO THRESH GATE TO			
	24R	24L	25R	25L	RWY	RWY	RWY	RWY	RWY	RWY	24R	24L	25R	25L	RWY	RWY	RWY	RWY	RWY	RWY	THRESH	TO GATE	THRESH	TO GATE
700-800	2.0	1.0	4.0	18.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	16.0	15.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0	9.59	4.21	7.22	7.22
800-900	9.0	2.0	14.0	19.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	25.8	20.0	8.4	0.0	0.0	0.0	0.0	0.0	0.0	10.31	4.43	13.59	13.59
900-1000	5.0	1.0	13.0	19.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	29.4	18.6	4.6	0.0	0.0	0.0	0.0	0.0	0.0	10.41	4.17	16.26	16.26
1000-1100	11.0	3.0	13.4	26.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0	20.6	15.5	6.0	0.0	0.0	0.0	0.0	0.0	0.0	10.95	4.49	13.43	13.43
1100-1200	12.0	2.0	23.4	21.6	0.0	0.0	0.0	0.0	0.0	0.0	5.0	17.0	14.9	9.0	0.0	0.0	0.0	0.0	0.0	0.0	11.20	4.45	9.49	9.49
1200-1300	13.0	2.0	10.2	21.4	0.0	0.0	0.0	0.0	0.0	0.0	3.7	25.5	19.4	14.3	0.0	0.0	0.0	0.0	0.0	0.0	11.07	4.39	16.89	16.89
1300-1400	8.0	2.0	9.3	20.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	24.7	14.0	14.8	0.0	0.0	0.0	0.0	0.0	0.0	10.20	4.43	17.59	17.59
1400-1500	10.0	5.0	13.7	25.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	12.8	14.9	11.6	0.0	0.0	0.0	0.0	0.0	0.0	10.32	4.35	10.65	10.65
1600-1700	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVERAGE DELAYS																								
TIME	ARRIVALS										DEPARTURES										AVERAGE DELAYS			
	24R	24L	25R	25L	RWY	RWY	RWY	RWY	RWY	RWY	24R	24L	25R	25L	RWY	RWY	RWY	RWY	RWY	RWY	ARR	DEF	DELAY	DEF
700-800	0.0	0.0	0.6	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.3	7.7	2.2	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1.7	1.7	1.7
800-900	0.2	0.0	0.9	1.3	0.0	0.0	0.0	0.0	0.0	0.0	3.9	3.3	11.0	5.5	0.0	0.0	0.0	0.0	0.0	0.0	1.2	7.6	7.6	7.6
900-1000	0.0	0.0	0.9	1.7	0.0	0.0	0.0	0.0	0.0	0.0	2.8	11.3	6.9	5.5	0.0	0.0	0.0	0.0	0.0	0.0	1.4	10.5	10.5	10.5
1000-1100	0.4	0.3	0.9	2.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	7.0	4.4	6.1	0.0	0.0	0.0	0.0	0.0	0.0	1.7	6.9	6.9	6.9
1100-1200	0.1	0.6	2.0	2.1	0.0	0.0	0.0	0.0	0.0	0.0	1.5	1.1	7.4	3.1	0.0	0.0	0.0	0.0	0.0	0.0	2.0	3.9	3.9	3.9
1200-1300	0.4	0.3	0.8	3.1	0.0	0.0	0.0	0.0	0.0	0.0	2.0	6.0	15.5	9.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	11.2	11.2	11.2
1300-1400	0.2	0.0	1.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	2.2	6.2	13.2	11.3	0.0	0.0	0.0	0.0	0.0	0.0	1.2	11.8	11.8	11.8
1400-1500	0.3	0.0	1.2	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.7	7.6	3.6	0.0	0.0	0.0	0.0	0.0	0.0	1.3	4.9	4.9	4.9
1600-1700	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GRAND TOTAL																								
AVERAGE DELAYS																								
TIME	ARRIVALS										DEPARTURES										AVERAGE DELAYS			
	24R	24L	25R	25L	RWY	RWY	RWY	RWY	RWY	RWY	24R	24L	25R	25L	RWY	RWY	RWY	RWY	RWY	RWY	ARR	DEF	DELAY	DEF
700-800	0.0	0.0	0.6	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.2	1.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
800-900	0.2	0.0	0.9	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.9	1.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0
900-1000	0.0	0.0	0.9	1.7	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.2	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0
1000-1100	0.4	0.3	0.9	2.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0
1100-1200	0.1	0.6	2.0	2.1	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0
1200-1300	0.4	0.3	0.8	3.1	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0	0.0
1300-1400	0.2	0.0	1.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0
1400-1500	0.3	0.0	1.2	1.4	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0
1600-1700	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

* CLEAN UP HOUR

LAX - STAGE 2EXPERIMENT NO. 22Objective:

To assess the delay impact to aircraft in (1982) for the following runway configuration in VFR 1 due to the runway closure of 25R during work on the Spulveda Tunnel.

ARRIVAL RUNWAYS

24R, 24L, 25L

DEPARTURE RUNWAYS

24R, 24L, 25L

Related Comparison Experiments:

Prior Experiment #1 is identical except for closure of 25R for tunnel construction and a 1978 demand.

LAX - STAGE 2EXPERIMENT NO. 22AObjective:

To assess the delay impact to aircraft in 1982 for the following runway configuration in VFR I due to the runway closure of 25R during work on the Sepulveda Tunnel with a dual taxiway system around satellite 4.

ARRIVAL RUNWAYS

24L, 24R, 25L

DEPARTURE RUNWAYS

24L, 24R, 25L

Related Comparison Experiments:

Prior Experiment #22 is identical except for a dual taxiway system

TABLE 12

LAX EXP 22A										DEMAND=82										SEP=78VFR1										CONFIG=A										SCHED=X22										RTE=X18										TAXI IMP																																							
AVERAGE FLOW RATES										AVERAGE DELAYS										AVERAGE DELAYS										AVERAGE DELAYS										AVERAGE DELAYS										AVERAGE DELAYS										AVERAGE DELAYS																																							
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LAX - STAGE 2EXPERIMENT NO. 25 (25A)Objective:

To assess delays to aircraft in 1987 for the following runway configuration in VFR 1 with an improved 1987 ATC system scenario and 1982 improvements plus the satellite terminal and/or remote parking for 20 aircraft (1987 improvement package). Experiment #25A is with greater peaks

ARRIVAL RUNWAYS

24R, 24L, 25R, 25L

DEPARTURE RUNWAYS

24R, 24L, 25R, 25L

Related Comparison Experiments:

Prior Experiment #11 is identical except for the improvements from 1982 to 1987, and the 1987 demand.

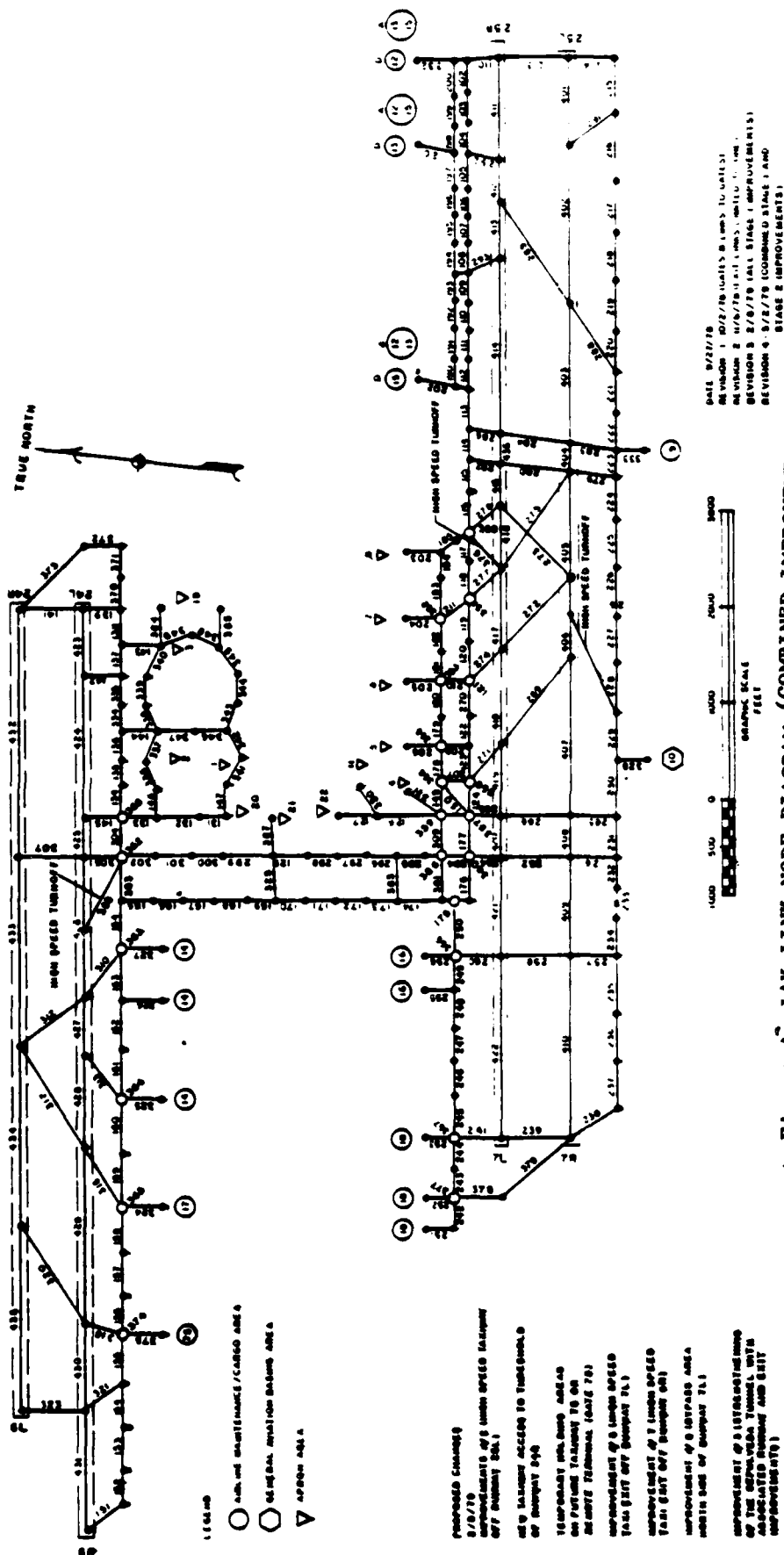


TABLE 15

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CLASS AND RUNWAY DEMAND DISTRIBUTION
FOR ARRIVALS AND DEPARTURES

EXPERIMENT NO. 25A

RUNWAY NAME	24R	24L	25R	25L	TOTAL
	ARRIVALS				
CLASS 1 (HEAVY)	19	13	29	25	86
CLASS 2 (LARGE)	56	40	59	61	216
CLASS 3 (SMALL)	17	11	0	26	54
CLASS 4 (SMALLER)	6	4	1	13	24
TOTAL	98	68	89	125	380

	DEPARTURES				
CLASS 1 (HEAVY)	0	42	59	17	118
CLASS 2 (LARGE)	4	86	102	54	246
CLASS 3 (SMALL)	28	1	6	26	61
CLASS 4 (SMALLER)	6	0	1	12	19
TOTAL	38	129	168	109	444

ARRIVAL AND DEPARTURE TOTALS	136	197	257	234	824
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TABLE 16
SET I DEMAND

EXPERI- MENT		RWY 24R	RWY 24L	RWY 25R	RWY 25L	TOTAL
23	A	167	0	0	196	363
	D	0	191	0	235	426
	TOTAL	167	191	0	431	789
24	A	174	0	189	0	363
	D	0	185	241	0	426
	TOTAL	174	185	430	0	789
26	A	162	0	0	207	369
	D	0	161	271	0	432
	TOTAL	162	161	271	207	801
	A					
	D					
	TOTAL					
	A					
	D					
	TOTAL					
	A					
	D					
	TOTAL					
	A					
	D					
	TOTAL					

LAX - STAGE 2EXPERIMENT NO. 23Objective:

To assess the delay impact to aircraft in (1982) for the following runway configuration in IFR 1 due to the runway closure of 25R during work on the Sepulveda Tunnel.

ARRIVAL RUNWAYS

24R, 25L

DEPARTURE RUNWAYS

24L, 25L

Related Comparison Experiments:

Prior experiment #2 is identical except for the closure of runway 25R for tunnel construction and a 1978 demand.

LAX - STAGE 2EXPERIMENT NO. 24Objective:

To assess the delay impact to aircraft in 1982 for the following runway configuration in IFR 1 due to the runway closure of 25L during work on the Sepulveda Tunnel

ARRIVAL RUNWAYS

24R, 25R

DEPARTURE RUNWAYS

24L, 25R

Related Comparison Experiments:

Prior Experiment #2 is identical except for the closure of runway 25L for tunnel construction and a 1978 demand.

TABLE 18

L/EXP/	LAX EXP 24	DEMAND=82	SEP=78IFR1	CONFIG=A	SCHED=X24	RTE=X1	NORMAL										
1	77 P28																
LAX EXP 24	DEMAND=82	SEP=78IFR1	CONFIG=A	SCHED=X24	RTE=X1	NORMAL											
AVERAGE FLOW RATES																	
TIME	ARRIVALS				DEPARTURES				AVERAGE TRAVEL TIMES								
	RWY	RWY	RWY	RWY	TOT	DE-	DIF	RWY	RWY	TOT	DE-	DIF	FIX TO THRESH	THRESH TO GATE	GATE TO ROLL		
	24R	24L	25R	25L		MAND		25L	25R		MAND						
700-800	10.0	0.0	15.1	0.0	0.0	0.0	25.1	27.0	-1.9	0.0	15.0	24.2	0.0	0.0	39.2	48.0	-8.8
800-900	19.0	0.0	23.4	0.0	0.0	0.0	42.4	44.0	-1.6	0.0	26.8	17.8	0.0	0.0	44.6	64.0	-19.4
900-1000	13.9	0.0	23.2	0.0	0.0	0.0	37.1	40.0	-2.9	0.0	31.5	16.3	0.0	0.0	47.8	54.0	-6.2
1000-1100	24.0	0.0	23.2	0.0	0.0	0.0	47.2	56.0	-8.8	0.0	16.7	21.3	0.0	0.0	38.0	48.0	-10.0
1100-1200	23.8	0.0	23.4	0.0	0.0	0.0	49.2	60.0	-10.8	0.0	19.3	19.9	0.0	0.0	39.2	52.0	-12.8
1200-1300	25.4	0.0	22.9	0.0	0.0	0.0	48.3	45.0	3.3	0.0	27.8	18.3	0.0	0.0	46.1	65.0	-18.9
1300-1400	25.2	0.0	22.6	0.0	0.0	0.0	47.8	39.0	8.8	0.0	27.4	14.3	0.0	0.0	43.7	54.0	-10.3
1400-1500	25.4	0.0	23.2	0.0	0.0	0.0	46.8	53.0	-6.4	0.0	18.2	20.8	0.0	0.0	39.0	41.0	-2.0
1500-1600	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVERAGE DELAYS																	
TIME	ARRIVALS				DEPARTURES				GRAND TOTAL								
	RWY	RWY	RWY	RWY	TOT	RWY	RWY	RWY	RWY	TOT	RWY	TAXI	RWY	ARR	DEP	DEL	
	24R	24L	25R	25L		24R	24L	25R	25L		CRS	OUT	CNG				
700-800	3.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	4.7		
800-900	2.3	0.0	6.7	0.0	0.0	0.0	4.7	1.1	2.0	2.9	20.6	0.0	0.0	9.9	0.0	11.1	
900-1000	2.3	0.0	14.8	0.0	0.0	0.0	10.1	1.1	3.0	7.6	41.0	0.0	0.0	18.9	0.0	22.4	
1000-1100	5.4	0.0	14.8	0.0	0.0	0.0	10.1	0.1	3.0	7.3	39.9	0.0	0.0	25.6	0.0	39.3	
1100-1200	11.7	0.0	26.8	0.0	0.0	0.0	18.9	0.1	0.0	2.7	39.3	0.0	0.0	21.3	0.0	34.6	
1200-1300	23.8	0.0	43.7	0.0	0.0	0.0	33.2	1.1	1.0	3.6	44.1	0.0	0.0	19.7	0.0	42.0	
1300-1400	17.9	0.0	39.6	0.0	0.0	0.0	28.1	0.4	0.0	7.6	47.0	0.0	0.0	22.2	0.0	35.0	
1400-1500	14.1	0.0	28.3	0.0	0.0	0.0	20.9	1.1	1.9	3.0	50.4	0.0	0.0	28.6	0.0	31.3	
1500-1600	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

* CLEAN UP HOUR

LAX - STAGE 2EXPERIMENT NO. 26Objective:

To assess delays to aircraft in 1987 for the following runway configuration in IFR 1 with an improved 1987 ATC system scenario and 1982 improvements plus the satellite terminal and/or remote parking for 20 aircraft. (1987 improvement package).

ARRIVAL RUNWAYS

24R, 24L, 25R, 25L

DEPARTURE RUNWAYS

24L, 25R

Related Comparison Experiments:

Prior Experiment #12 is identical except for the improvements from 1982 to 1987 and the demand. (1987)

TABLE 20

LAX EXP 26 DEMAND-87 SEP-87IFR1 CONFIG-A SCHED=X26 RTE=X25 TOTAL IMP									
AVERAGE FLOW RATES									
TIME	ARRIVALS			DEPARTURES			DIF	AVERAGE TRAVEL TIMES	
	RNY	RNY	RNY	RNY	RNY	RNY		FIX TO THRESH	GATE ID
	24R	24L	25R	25L	24R	24L		THRESH TO GATE	RUL
700-800	13.0	0.0	0.0	16.7	0.0	0.0	-7.3	9.89	5.89
800-900	22.0	0.0	0.0	22.7	0.0	0.0	-2.3	11.85	8.97
900-1000	12.0	0.0	0.0	26.4	0.0	0.0	1.4	10.63	9.49
1000-1100	25.0	0.0	0.0	32.0	0.0	0.0	1.0	11.24	8.40
1100-1200	25.0	0.0	0.0	34.0	0.0	0.0	-1.0	11.49	8.66
1200-1300	23.0	0.0	0.0	24.0	0.0	0.0	-2.0	14.02	11.75
1300-1400	16.0	0.0	0.0	27.2	0.0	0.0	2.2	14.08	12.18
1400-1500	26.0	0.0	0.0	24.0	0.0	0.0	2.0	11.50	7.12
GRAND TOTAL	140.0	0.0	0.0	140.0	0.0	0.0	0.0	11.50	7.12
TIME	ARRIVALS			DEPARTURES			DIF	AVERAGE DELAYS	
	RNY	RNY	RNY	RNY	RNY	RNY		ARR	DEF
	24R	24L	25R	25L	24R	24L		DELAY	DELAY
700-800	1.2	0.0	0.0	2.3	0.0	0.0	1.1	1.9	4.3
800-900	1.2	0.0	0.0	2.3	0.0	0.0	1.1	1.9	4.3
900-1000	1.1	0.0	0.0	1.9	0.0	0.0	0.8	1.5	4.7
1000-1100	1.8	0.0	0.0	2.2	0.0	0.0	0.4	1.7	4.1
1100-1200	1.5	0.0	0.0	3.0	0.0	0.0	1.5	2.1	4.5
1200-1300	1.4	0.0	0.0	8.1	0.0	0.0	6.7	4.6	7.1
1300-1400	1.2	0.0	0.0	7.3	0.0	0.0	6.1	4.8	8.0
1400-1500	1.0	0.0	0.0	2.2	0.0	0.0	1.2	1.7	3.2
GRAND TOTAL	10.0	0.0	0.0	30.0	0.0	0.0	20.0	1.7	3.2

* CLEAN - UP HOUR

ATTACHMENT D

SUMMARY OF EXPERIMENT RESULTS FOR
TOTAL DELAYS AND TRAVEL TIMES

LOS ANGELES INTERNATIONAL AIRPORT

AIRPORT IMPROVEMENT TASK FORCE DELAY STUDIES

TABLE 21
SUMMARY OF DELAYS FOR VFR
WESTERLY FLOW

EXPERIMENT	ARRIVALS			DEPARTURES				TOTAL GROUND DELAYS
	RUNWAY (AIRBORNE)	TAXIWAY	RUNWAY CROSSING	RUNWAY	TAXIWAY	RUNWAY CROSSING	GATE HOLD	
1	802.9	46.4	80.1	2791.8	482.1	1.9	74.4	3476.7
7	634.3	56.8	81.2	2597.8	562.0	7.6	30.2	3355.6
7A	1576.4	66.4	118.8	4182.0	897.0	4.1	293.4	5561.6
7B	5671.0	226.4	104.9	5540.9	1590.9	3.9	1118.4	8587.7
11	1357.5	123.3	108.2	4130.0	1357.3	3.8	1133.4	6856.0
11 (REROUTED)	405.2	57.5	86.8	2048.0	494.4	8.3	6.1	3106.3
13	436.1	61.4	87.9	2379.9	468.0	8.0	20.6	3025.8
18	516.1	48.2	58.9	2626.4	561.1	9.2	26.8	3330.6
18 (REROUTED)	381.5	48.1	59.7	2277.0	484.5	10.4	31.2	2910.9
18A (REROUTED)	408.6	54.9	62.4	2189.6	659.4	10.0	3.2	2979.5
19A	525.2	38.6	45.0	2345.5	423.9	7.5	12.0	2872.5
20	420.1	47.8	50.6	2493.6	431.9	7.8	52.1	3083.8
21	440.7	45.7	62.8	2667.5	587.9	6.2	28.2	3398.3
22	3072.8	56.8	15.7	4343.0	354.7	2.1	693.6	5393.3
22 (REROUTED)	992.8	233.5	18.5	4199.5	1449.7	11.6	944.0	6856.8
22A (REROUTED)	1034.3	187.4	16.2	4071.4	1359.2	11.6	1047.8	6410.0
25	188.7	34.3	31.7	1324.7	245.1	1.3	1.6	1653.7
25A	257.1	39.7	38.4	1957.2	444.8	1.4	72.8	2524.3

TABLE 22

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TABLE 23
SUMMARY OF DELAYS FOR VFR AND IFR
EASTERLY FLOW 6, 9 and 16
NIGHT TIME 4, 10 and 15 (VFR) 5 and 10A (IFR)

EXPERIMENT	ARRIVALS			DEPARTURES				TOTAL GROUND DELAYS
	RUNWAY (AIRBORNE)	TAXIWAY	RUNWAY CROSSING	RUNWAY	TAXIWAY	RUNWAY CROSSING	GATE HOLD	
6	460.0	166.4	42.0	2546.2	605.7	0.3	384.2	3771.8
9	408.2	84.8	56.5	2370.1	406.0	9.5	67.0	3301.9
16	331.9	76.0	62.1	2270.5	308.7	12.8	64.8	2797.9
4	374.2	3.1	0.0	457.0	5.1	0.0	0.0	465.2
10	1034.5	3.8	0.0	686.4	15.1	0.0	0.0	705.3
15	844.3	3.8	0.0	616.7	14.7	0.0	0.0	635.2
5	1244.9	4.3	0.0	1129.5	5.1	0.0	0.0	1138.9
10A	2048.3	3.8	0.0	1285.2	12.6	0.0	0.0	1301.6

TABLE 24
SUMMARY OF TRAVEL TIMES
(MINUTES)

EXPERIMENT	ARRIVAL AIRBORNE TRAVEL TIME	ARRIVAL GROUND TRAVEL TIME	DEPARTURE GROUND TRAVEL TIME	TOTAL TRAVEL TIME
1	4076.9	1528.6	5677.0	11282.5
7	4026.7	1609.6	5659.3	11295.6
11 (REROUTED)	3797.0	1501.4	4801.3	10100.2
13	3828.1	1610.7	5304.0	10742.8
18 (REROUTED)	3785.8	1624.8	5348.7	10759.3
18A (REROUTED)	3747.7	1629.1	5175.2	10552.0
19A	3822.6	1586.4	5151.4	10560.4
22 (REROUTED)	4403.4	2100.1	9082.1	15504.4
22A (REROUTED)	4444.3	2101.3	9000.9	15546.5
25	3720.1	1452.1	3519.3	8691.5
2	7609.6	1548.4	5597.1	14755.1
8	8323.9	1577.7	5568.1	15469.7
12 (REROUTED)	5405.8	1664.8	5444.3	12514.9
24 (REROUTED)	8626.2	1910.9	13504.5	36556.5
26	4392.4	1516.8	4010.4	9919.6

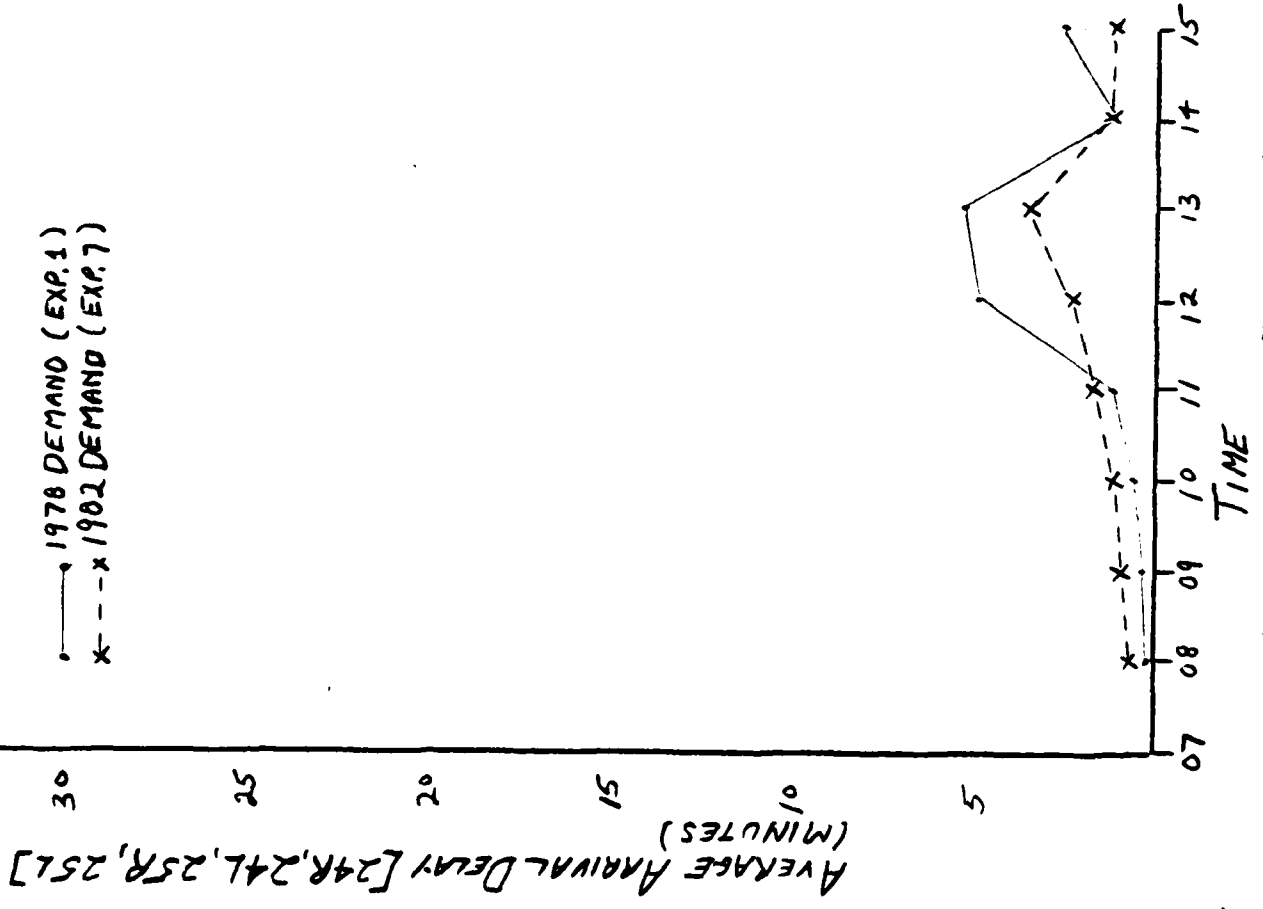
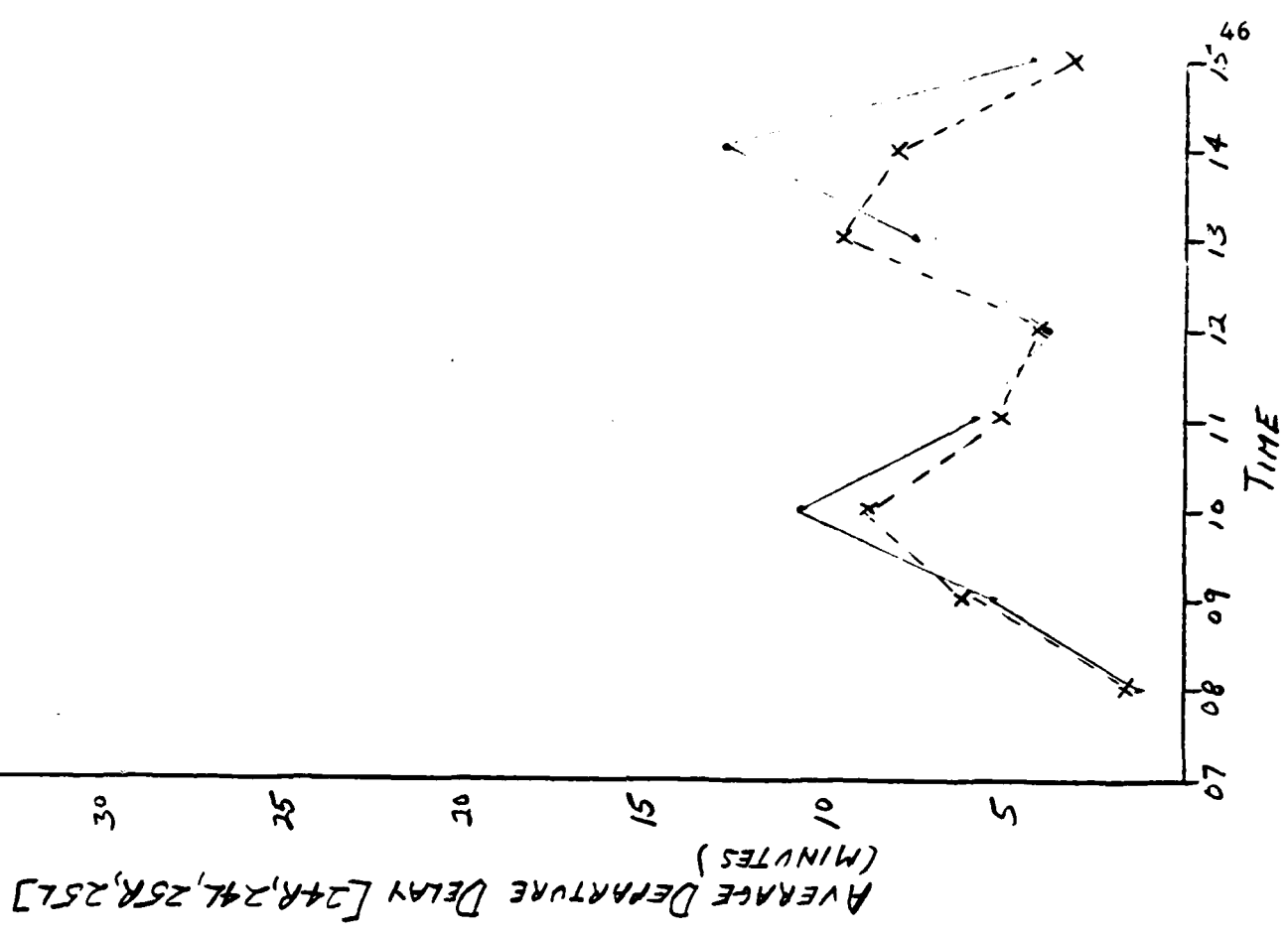
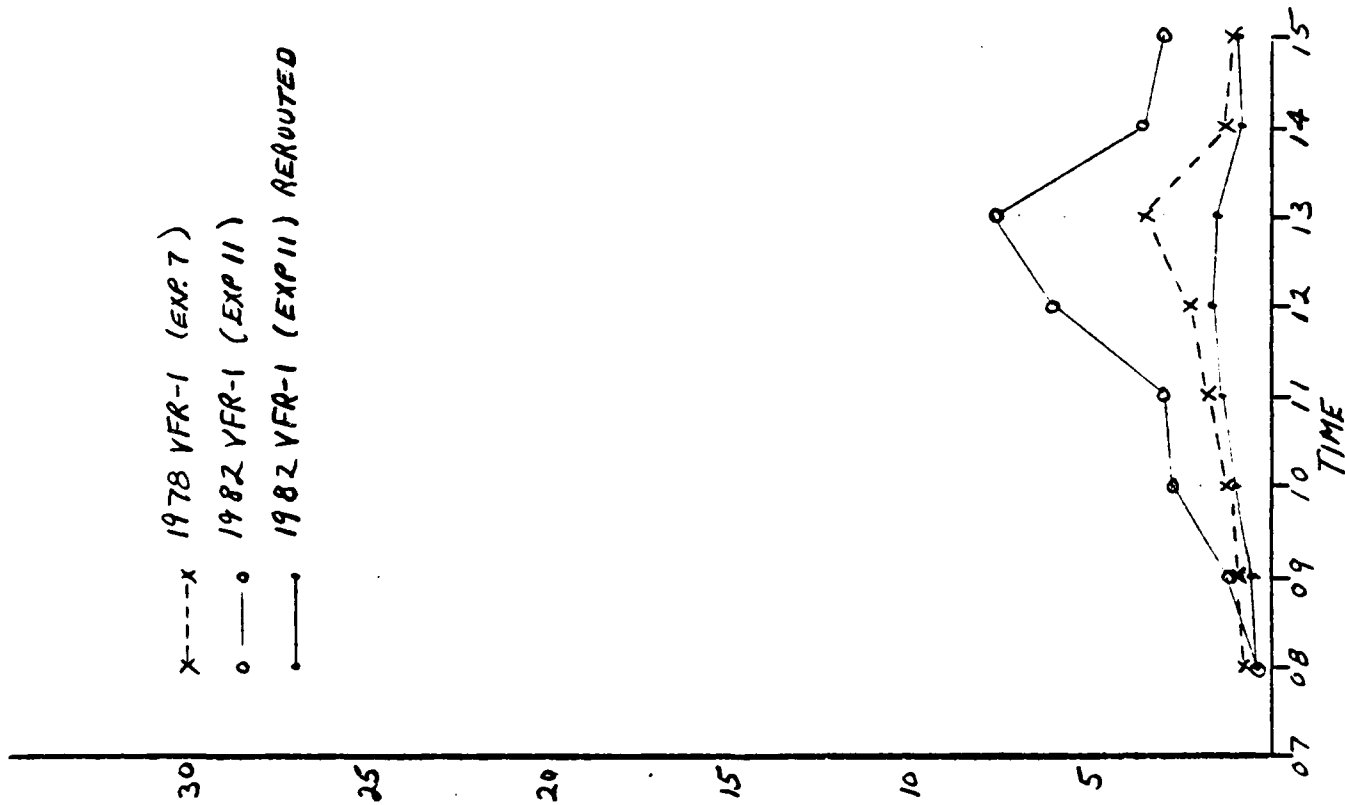


FIGURE 7. VFR (1978) COMPARISON - WESTERLY FLOW

AVERAGE ARRIVAL DELAY [24R, 24L, 25R, 25L]
(MINUTES)

- x---x 1978 VFR-1 (EXP. 7)
- o---o 1982 VFR-1 (EXP. 11)
- 1982 VFR-1 (EXP. 11) REROUTED



AVERAGE DEPARTURE DELAY [24R, 24L, 25R, 25L]
(MINUTES)

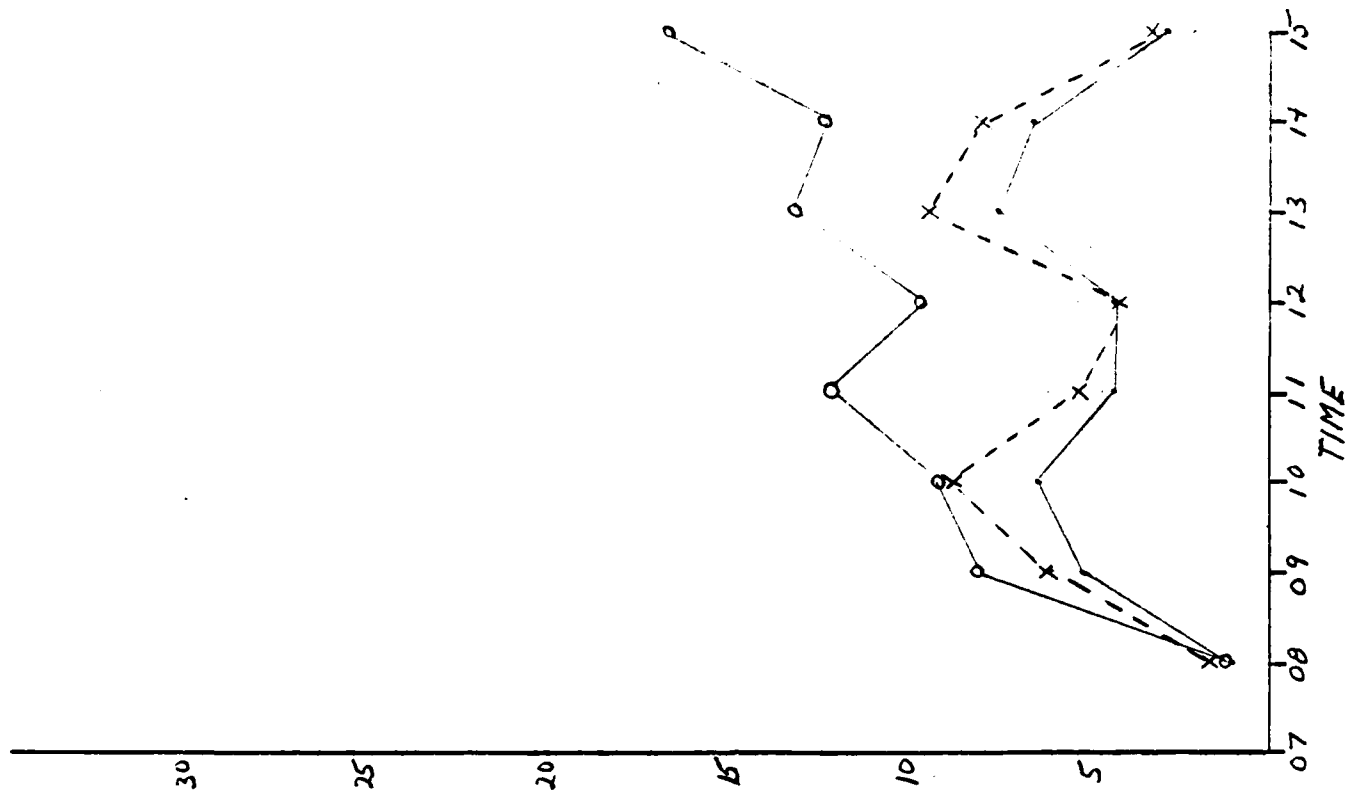


FIGURE 8 VFR (1978 AND 1982) COMPARISON WESTERLY FLOW

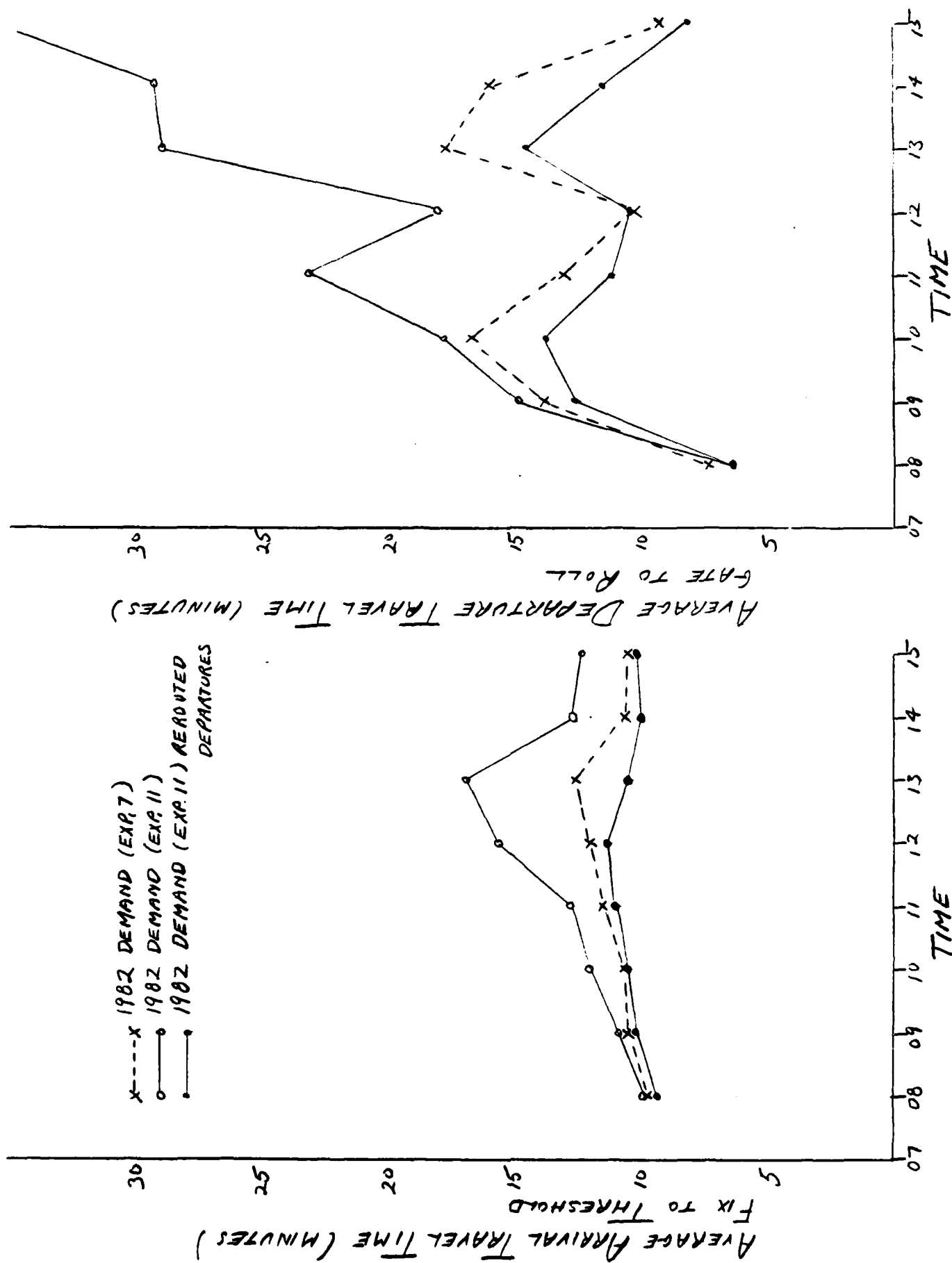


FIGURE 9 VFR (1978 AND 1982) COMPARISON - WESTERLY FLOW

x---x 1978 IFR-1 (EXP 8) MODIFIED
 — 1982 IFR-1 (EXP 12) MODIFIED

AVERAGE ARRIVAL DELAY [24R, 25L] (MINUTES)

AVERAGE DEPARTURE DELAY [24L, 25R] (MINUTES)

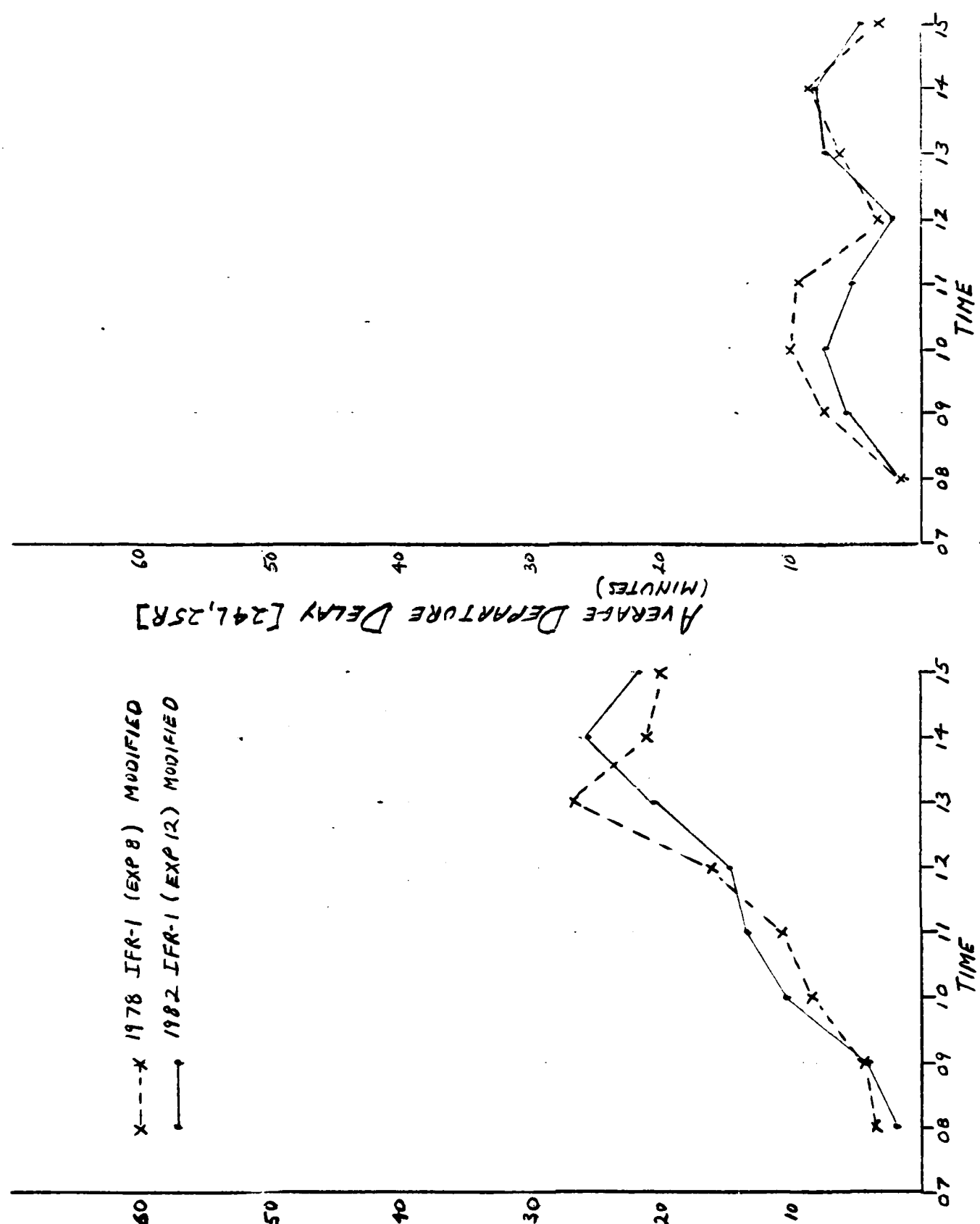
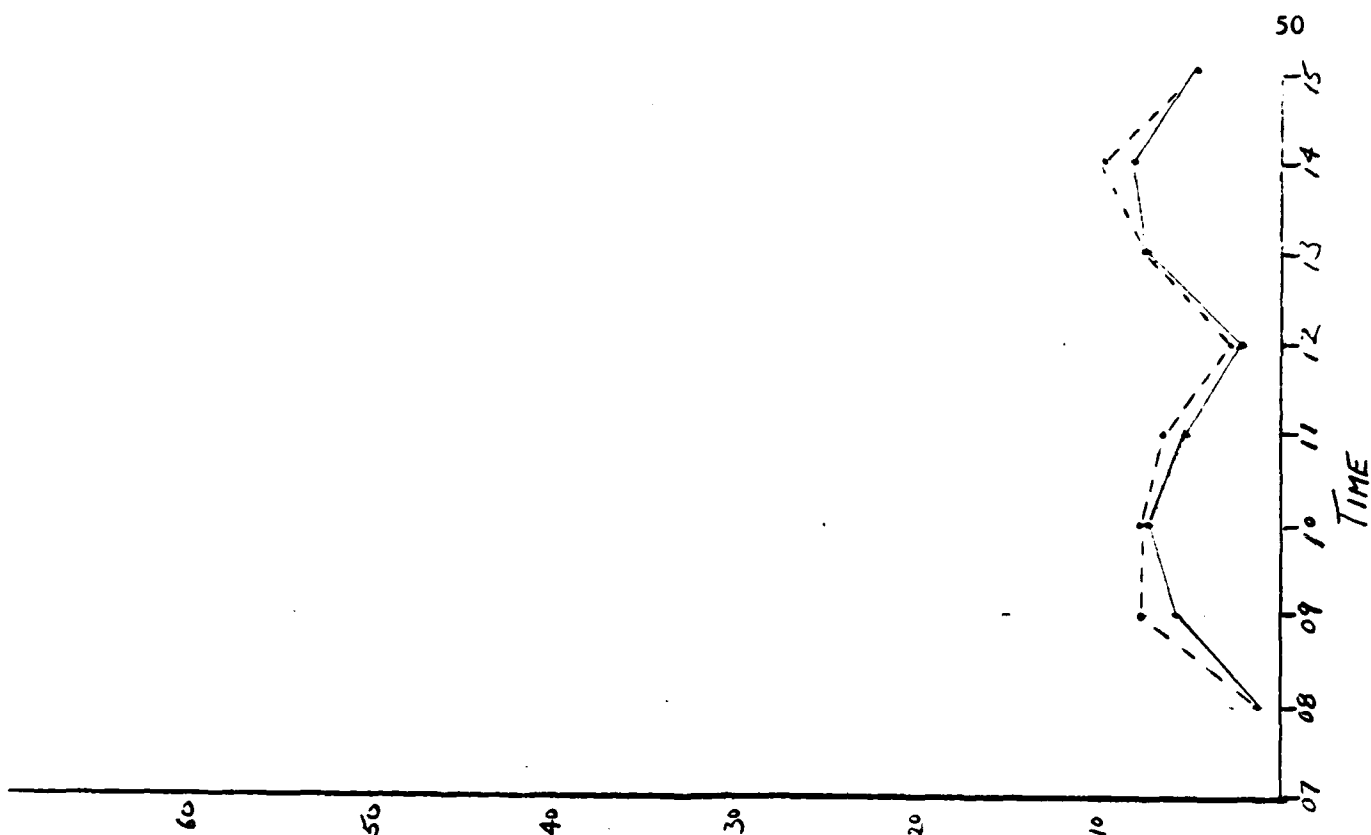


FIGURE 10 IFR-1 (1978 AND 1982) COMPARISON-WESTERLY FLOW

1982 IFR-1 (EXP12) MODIFIED DEMAND
 1982 IFR-1 (EXP12)
 (MODIFIED DEMAND WITH
 REROUTED DEPARTURES)

AVERAGE DEPARTURE DELAY [24L, 25R] (MINUTES)



AVERAGE ARRIVAL DELAY [24R, 25L] (MINUTES)

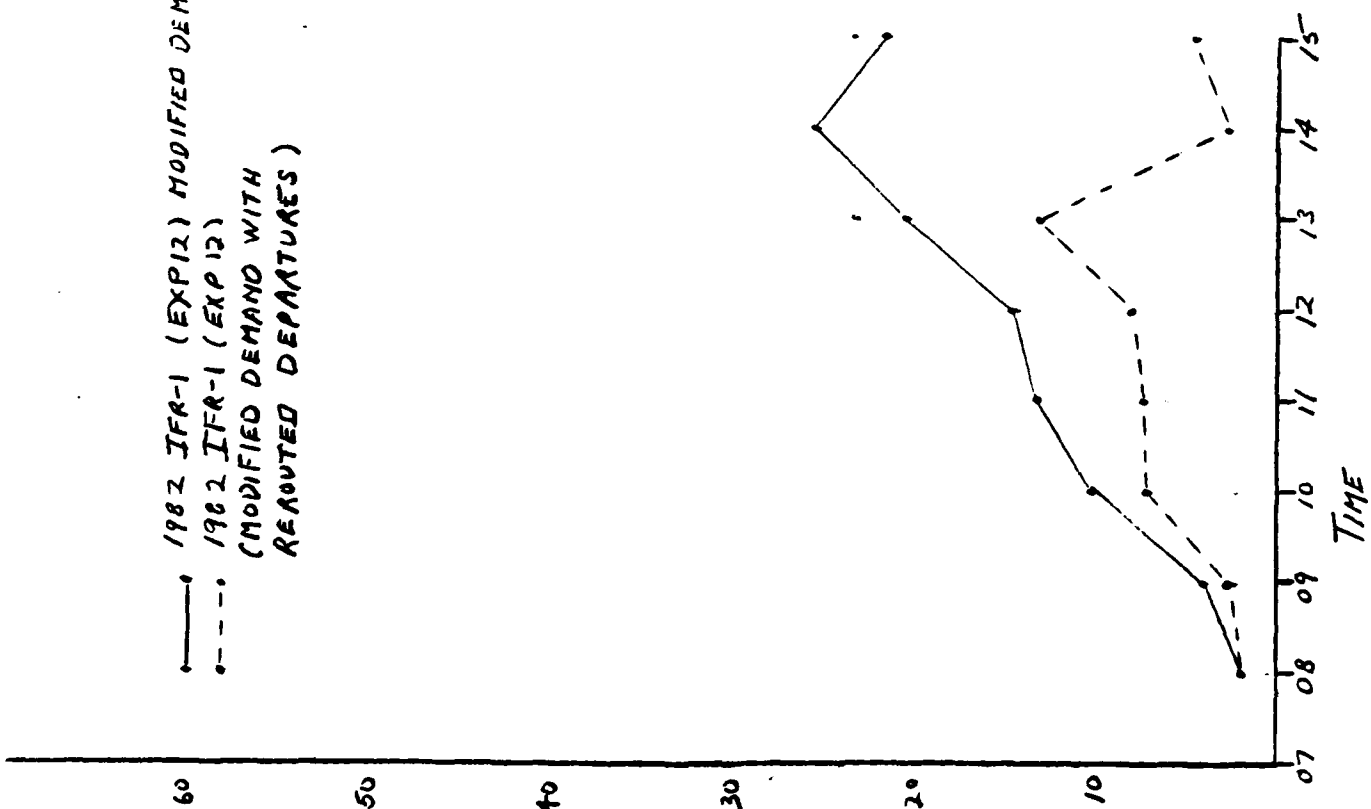


FIGURE 11 IFR-1 (1982) COMPARISON - WESTERLY FLOW

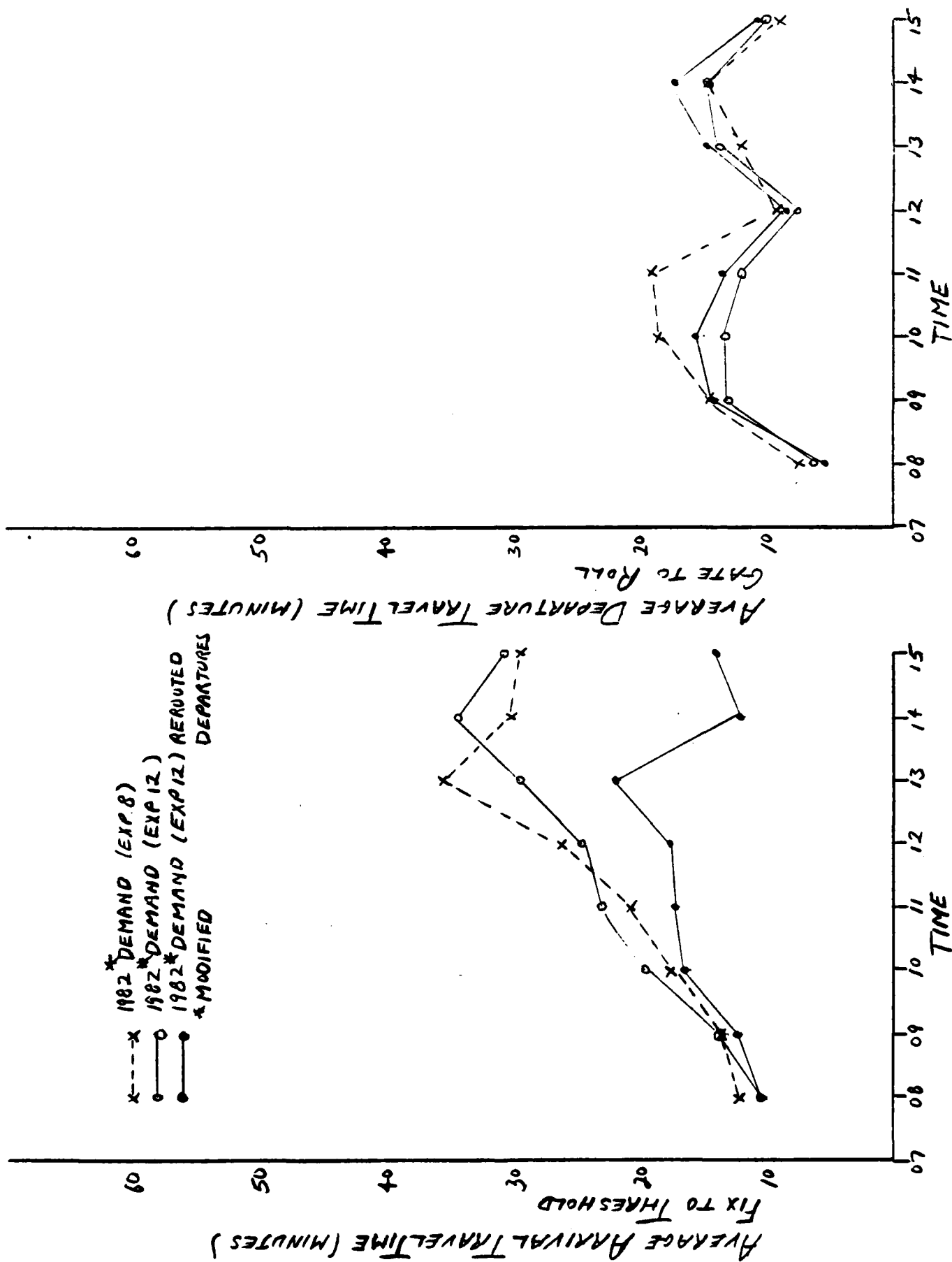


FIGURE 12 IFR (1970 AND 1982) COMPARISON - WESTERLY FLOW

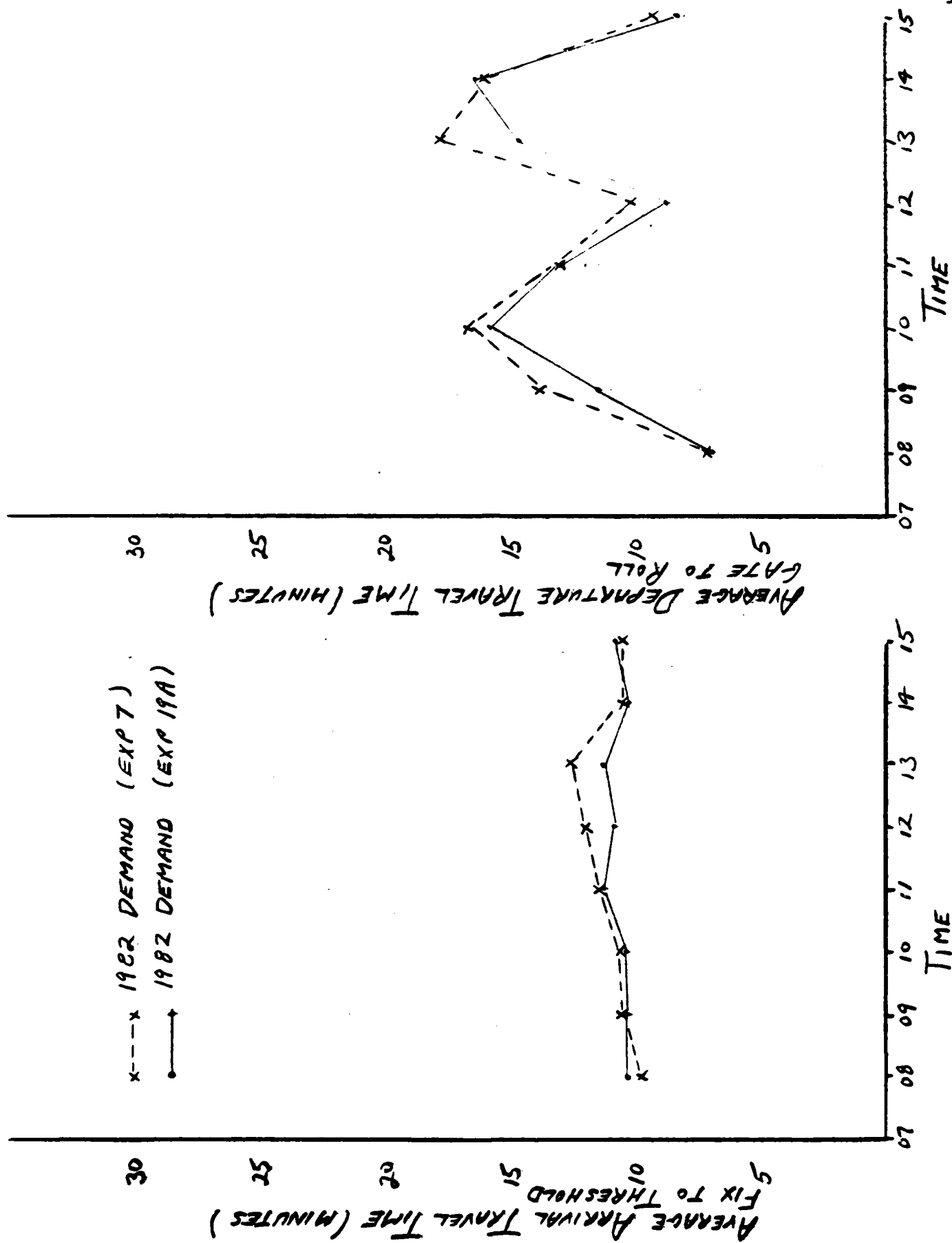


FIGURE 14 VFR (1978) COMPARISON - WESTERLY FLOW

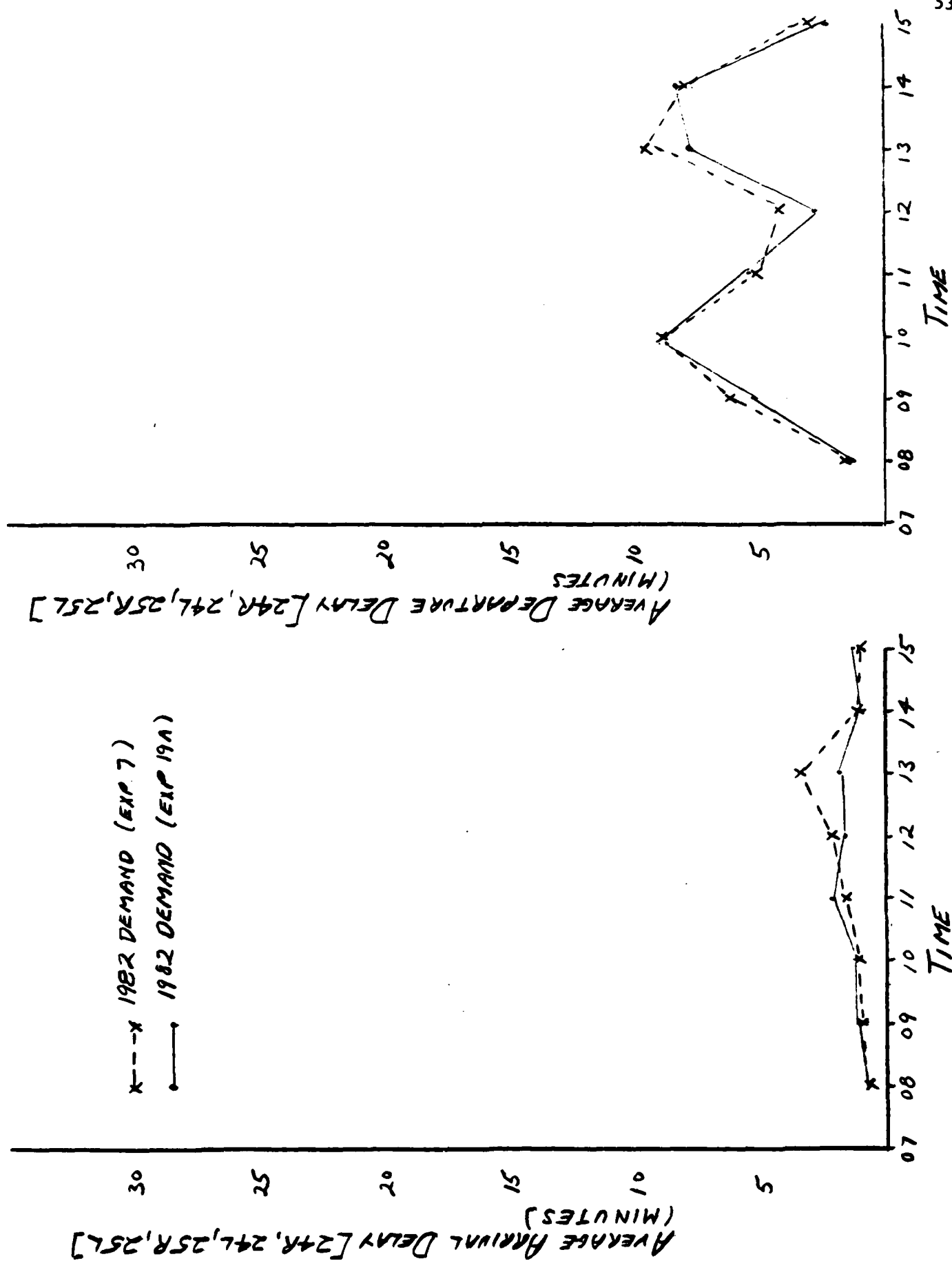


FIGURE 13 VFR (1978) COMPARISON - WESTERLY FLOW

ATTACHMENT E

COMPARISON OF EXPERIMENTS

LOS ANGELES INTERNATIONAL AIRPORT

TABLE 25
COMPARISON OF EXPERIMENTS

EXPERIMENT	ARRIVALS			DEPARTURES			TOTAL GROUND DELAYS	TRAVEL TIMES			
	RUNWAY (AIR)	TAXI	RUNWAY X-ING	RUNWAY	TAXI	RUNWAY X-ING		GATE HOLD	ARRIVAL AIR	ARRIVAL GROUND	DEPART. GROUND
IMPROVEMENT- NEAR TERM IMPROVEMENTS (TUNNEL)											
RESULTS- 10% improvement in departure ground travel time.											
* 11 (REMOVED)	405.2	57.5	86.8	2048.0	494.4	8.3	6.1	3106.3	3797.0	1501.9	4894.8
* 18 (REMOVED)	381.5	48.1	59.7	2277.0	484.5	10.4	31.2	2910.9	3785.8	1624.8	5348.7
IMPROVEMENT- 1982 SEPARATIONS AND NEAR TERM IMPROVEMENTS											
RESULTS- 36.1% improvement in airborne delays and 21.0% improvement in departure delays.											
7	634.3	56.8	81.2	2597.8	562.0	7.6	30.2	3335.6	4026.7	1609.6	5659.3
* 11 (REMOVED)	405.2	57.5	86.8	2048.0	494.4	8.3	6.1	3106.3	3797.0	1501.9	4801.8
IMPROVEMENT-BY-PASS FOR 24L TO 24R											
RESULTS- 6.2% improvement in departure travel times.											
7	634.3	56.8	81.2	2597.8	562.0	7.6	30.2	3335.6	4026.7	1609.6	5659.3
* 13	436.1	61.4	87.9	2379.9	468.0	8.0	20.6	3025.8	3828.1	1610.7	5304.0
IMPROVEMENT- DUAL TAXIWAY											
RESULTS- NO CHANGE											
* 11 (REMOVED)	405.2	57.5	86.8	2048.0	494.4	8.3	6.1	3106.3	3797.0	1501.9	4801.8
* 18 (REMOVED)	381.5	48.1	59.7	2277.0	484.5	10.4	31.2	2910.9	3785.8	1624.8	5348.7

TABLE 25 (continued)

COMPARISON OF EXPERIMENTS

EXPERIMENT	ARRIVALS			DEPARTURES			TOTAL GROUND DELAYS	TRAVEL TIMES				
	RUNWAY (AIR)	TAXI	RUNWAY X-ING	RUNWAY X-ING	TAXI	GATE HOLD		ARRIVAL AIR	ARRIVAL GROUND	DEPART. GROUND	TOTAL	
TUNNEL CONSTRUCTION												
RESULTS- Larger departure delays can be expected (about 56%).												
7	634.3	56.8	81.2	2577.8	562.0	7.6	30.2	3335.6	4026.7	1609.6	5659.3	11295.6
22 (AEROUTED)	992.8	233.5	18.5	4112.5	1449.7	11.1	944.0	6490.0	4403.4	2100.1	9082.1	15504.4
IMPROVEMENT- TERMINAL EXPANSION												
RESULTS- 15.1% improvement in airborne delay.(5% in airborne travel time.)												
8.(5 improvement in departure travel time.)												
7	634.3	56.8	81.2	2597.8	562.0	7.6	30.2	3335.6	4026.7	1609.6	5659.3	11295.6
* 19A	525.2	38.6	45.0	2345.5	423.9	7.5	12.0	2872.5	3822.6	1586.4	5757.4	10560.4
IMPROVEMENT- 1982 SEPARATIONS AND NEAR TERM IMPROVEMENTS. (IFR)												
RESULTS- 54% improvement in airborne delay.												
8	5011.6	39.1	62.8	2713.6	164.2	4.7	304.0	3288.4	8323.1	1577.7	5568.1	15462.7
* 12 (AEROUTED)	2320.8	50.0	58.4	2713.0	189.0	6.2	290.6	3307.2	5905.8	1664.8	5444.3	12514.9
IMPROVEMENT- LONG TERM IFR SEPARATIONS												
RESULTS- Reduce delays to present day VFR conditions.												
1	802.9	46.4	80.1	2791.8	482.1	1.9	74.4	3476.7	4076.9	1528.6	5671.0	11282.5
* 26	831.2	22.9	35.0	1922.8	88.3	1.6	79.4	2150.0	4392.4	1516.8	4010.4	9919.6

TABLE 25 (continued)
COMPARISON OF EXPERIMENTS

[illegible]

ATTACHMENT F

SUMMARY OF ANNUAL DELAYS

TABLE 25

EXPERIMENT	DEMAND	ATC SYSTEM SCENARIO	IMPROVEMENTS	ANNUAL DELAY (HOURS)
17	1978	1978	NONE	37,991
27	1982	1982	1982	<u>21,036</u>
28	1982	1982	NONE	<u>33,953</u>
29	1982	1978	1982	33,150
30	1982	1978	NONE	39,630
31	1987	1987	1987	13,496
32	1987	1987	NONE	21,728 (EST.)
33	1987	1978	1987	21,188 (EST.)
34	1987	1978	NONE	<u>41,339</u> (EST.)

DATE
ILME